

A.1 Province of Alberta (Canada)

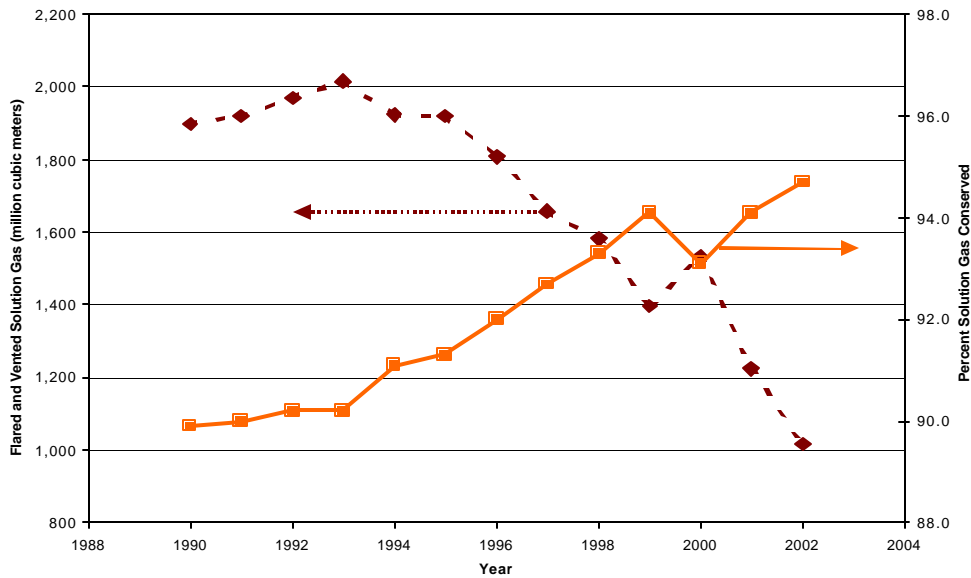
Overview of Onshore Gas Flaring and Venting in Alberta

The energy industry in Alberta has made considerable progress in reducing flaring and venting volumes from upstream oil sources.⁵⁶

By 2002, the flaring of solution gas had been reduced by 62 percent from the 1996 flaring baseline of 1,340 million cubic meters (mcm).⁵⁷ Solution gas venting has been reduced by 29 percent from the 2000 venting baseline of 704 mcm. The volume of solution gas flared and vented has declined from the 1996 volume of 1,808 mcm to 1,010 mcm in 2002, an overall decrease of 44 percent.⁵⁸

Figure A.1 shows the percentage of solution gas conserved and the volume flared and vented for each year from 1992 to 2002.⁵⁹

Figure A.1 Solution Gas Conserved and Volume Flared and Vented



⁵⁶ Alberta is landlocked and does not have offshore production.

⁵⁷ Alberta uses the terminology “solution gas and gas conservation” to describe natural gas contained in crude oil using natural gas. In other jurisdictions and in this report it is generally referred to as “associated gas and gas use.”

⁵⁸ *Upstream Petroleum Industry Flaring and Venting Report, Industry Performance for Year Ending December 31, 2002*, September 2003.

⁵⁹ Conservation refers to the use of solution gas as fuel for production facilities, for reinjection into an oil or gas pool, or for sale in the downstream market (for example, for power generators).

Flared and Vented Solution Gas in Alberta

Alberta's Government Policy on Gas Flaring and Venting

Gas flaring and venting in Canada is generally a matter of provincial jurisdiction. The Environmental Protection and Enhancement Act (EPEA) provides for the development of guidelines and environmental quality objectives for the province of Alberta. Alberta's air quality guidelines (Alberta Ambient Air Quality Guidelines) are established under EPEA.⁶⁰ The air quality guidelines specify parameters such as maximum concentrations of water (H₂O), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), and carbon monoxide (CO).

Alberta Environment,⁶¹ a government body, regulates air emissions in the province of Alberta and is responsible for setting emissions and air quality standards. These standards are subsequently applied by the Alberta Energy and Utilities Board (EUB) to set upstream petroleum industry gas flaring and venting targets.

Alberta allows industry, public, environmental nongovernmental organizations (ENGOS), and regulators to participate in assessing air quality issues and recommending management actions. The Clean Air Strategic Alliance (CASA)⁶² is a multistakeholder forum sponsored by the government of Alberta that provides recommendations on policy and regulation related to air quality. Although CASA does not have legislative authority, agencies such as Alberta Environment and the EUB receive CASA recommendations and implement subsequent regulations and guidelines, as appropriate. The CASA process is viewed as being constructive and including interested parties, and the consensus built helps to forge a strong commitment to implement resulting recommendations. The petroleum industry and the EUB initiated CASA teams to make consensus recommendations on gas flaring and venting management in 1998 and 2002.

Who Regulates Gas Flaring and Venting in Alberta?

The EUB⁶³ has the primary responsibility for regulating the upstream petroleum industry in the province⁶⁴ and for conserving solution gas, and has consolidated its requirements in *Guide 60: Upstream Petroleum Industry Flaring, Incinerating and Venting*.⁶⁵ It provides regulatory

⁶⁰ Refer to Section 14 of EPEA.

⁶¹ <http://www3.gov.ab.ca/env>.

⁶² CASA is a nonprofit association composed of diverse stakeholders from government, industry, and nongovernmental organizations (such as health and environmental groups). Senior representatives from each of the three sectors are committed to developing and applying a comprehensive quality management system for the people of Alberta through a consensus-based process.

⁶³ <http://www.eub.gov.ab.ca>.

⁶⁴ The EUB also regulates crude oil and natural gas pipelines within Alberta, while the National Energy Board (NEB) regulates energy transportation across interprovincial and international borders and must approve exports, transportation charges, and operation of facilities.

⁶⁵ The guide is now in its second iteration and incorporates consensus recommendations of a joint committee of industry, environmental nongovernment organizations, and regulatory agency representatives. A copy of the guide is available on www.eub.gov.ab.ca/bbs/products/guides/g60/g60-draft.pdf.

The other western Canadian provinces (British Columbia and Saskatchewan) often refer to Alberta practices in the development of provincial requirements. The NEB has consulted the EUB on upstream industry requirements and has used this information in its regulatory development processes.

guidelines for flaring, incinerating,⁶⁶ and venting in Alberta, as well as procedural information for flare permit applications and the measuring and reporting of flared and vented gas. In addition to upstream petroleum industry facilities, the guidelines also apply to gas transmission facilities licensed by the EUB. *Guide 60* is based on CASA recommendations on gas flaring and venting.

Following recommendations of CASA, in 1999 the EUB established a solution gas flaring reduction target for Alberta for the year 2001, with the objective of reducing flaring by 25 percent of the flared volume in 1996. Actual reductions in 2000 were more than double the industry target, and the requirements for 2002 held solution gas flaring to not more than 50 percent of the volume flared in 1996. Flaring of solution gas has been reduced by approximately 62 percent from 1996.

For 2002, the EUB had the following targets and limits for gas flaring in Alberta:

- a. 670 mcm;⁶⁷ and
- b. if solution gas flaring exceeds the 670 mcm limit in a year, the EUB will impose reductions that will stipulate maximum solution gas flaring limits for individual operating sites based on analysis of the most current annual data.

A summary of the targets of the past four years is given below.

Table A.2 Solution Gas Flaring Reduction Schedule

Year	Firm target reduction (%)	Actual reduction (%)
1999	None established	30
2000	15	38
2001	25	53
2002	50	62
2003	no target set	data to be released*

*Data are expected to be released in the second quarter of 2004.

The above figures show that progress has been made in reducing solution gas flaring. Other reductions reported in 2002 include:⁶⁸

- Solution gas flaring was reduced to 514 mcm, 18 percent less than in 2002
- Solution gas venting decreased by 98 thousand cubic meters (tcm), or 16 percent
- Well-test flaring decreased by 46 mcm, or 14 percent; 8 percent less

⁶⁶ For the purposes of associated gas management and reporting, incinerated gas is considered flared gas.

⁶⁷ That is 50 percent of the revised 1996 baseline of 1,340 million cubic meters.

⁶⁸ EUB News Release 2002 Flaring and Venting Industry Performance Report: Solution Gas Flaring Reduced by 62 percent since 1996[is this a title? If so, ital entire title and capitalize as appropriate].

- Gas plants flared or vented a total of 127 mcm; a decrease of 32 mcm, or 20 percent
- Industry achieved a 94.7 percent solution gas conservation rate in 2002, compared with 94.1 percent in 2001. This is the best conservation rate achieved to date.

In 2002, the CASA team decided that before setting new reduction targets for 2003, an economic evaluation of gas conservation in Alberta should be carried out. CASA and the EUB are in the process of analyzing economic evaluation data and are in the midst of developing the next round of targets.

The EUB is currently not setting venting reduction targets, and gas vented increased from 459 mcm in 1999 to 704 mcm in 2000. The venting increase was found to result both from start-up of new, significant heavy oil operations and from improved reporting of gas venting. The former resulted from the commencement of oil production before gas conservation systems were complete. A greater regulatory and industry focus on measurement and reporting of vented gas as a result of the 1999 introduction of the EUB's flaring guide was a key factor in better reporting of vented volumes. Table A.3 provides an overview of gas flared and vented between 1999 and 2002.

Table A.3 Breakdown of Gas Flaring and Venting (in mcm)

Year	Flaring	Venting
1999	937	459
2000	831	704
2001	624	600
2002	514	502

To counter the problem of increasing venting volumes, the EUB has initiated a number of measures designed to achieve a reduction of gas venting. The measures include a requirement that all existing sources of vented gas greater than 500 m³/day be evaluated by December 31, 2003, and if economic to do so, be conserved by December 2004. In addition, all proposed new vent sources must be evaluated as part of the project planning and application process.⁶⁹

The EUB does not consider venting an acceptable alternative to flaring. CASA is currently considering making recommendations in this regard. This will ensure that companies will not be able to decrease their flare volumes by increasing their venting volumes.

How Has Gas Flaring and Venting Regulation Been Conducted?

Guide 60 provides regulatory requirements and guidelines for gas flaring and venting in Alberta, as well as procedural information for flare permit applications and the measuring and reporting of flared and vented gas.⁷⁰

⁶⁹ Further details can be found in *General Bulletin GB 2002–2005*, May 16, 2002, EUB.

⁷⁰ In addition to upstream petroleum facilities, the guide also applies to gas transmission facilities licensed by the EUB.

The key elements of gas flaring and venting regulation in Alberta include:

- The gas flaring and venting management framework and decision tree
- Economic evaluation of gas conservation
- Gas flaring and venting performance requirements
- Measurement and reporting of gas flaring and venting
- The enforcement ladder.

Each element will be discussed in more detail below.

Gas Flaring and Venting Management Framework and Decision Tree

Regulation of flaring and venting in Alberta seeks not only to address solution gas conservation, but also to prevent adverse health and environmental impacts related to flare and venting emissions.

The EUB has adopted CASA's objective hierarchy and its framework for managing routine solution gas flaring and has extended its application to include flaring and venting of gas in general.⁷¹ Alberta requirements are founded on a framework that requires operators of petroleum production facilities to:

- Evaluate opportunities to eliminate flaring and venting
- Assess opportunities to reduce flaring and venting if the activity cannot be feasibly eliminated
- Ensure that any residual flaring and venting is conducted in compliance with performance requirements.

All proposed flares and vents must be evaluated by oil producers using the flaring and venting management framework⁷² (figure A.2) and decision-tree process (figure A.3).

Economic Evaluation of Gas Conservation

A key concept regulation is the economic evaluation of gas conservation, and companies are required to evaluate opportunities to conserve flared and vented gas. EUB's policy is that gas must be conserved if conservation is determined to be economic. The evaluation is conducted using an incremental rather than an integrated basis. The EUB does not require solution gas conservation if it is not economic to do so.

In principle, a project is considered economic if the incremental economics of gas conservation generates a net present value before tax greater than zero. The EUB has specified economic evaluation procedures, assumptions, and parameters for evaluating gas flaring and venting in *Guide 60*.⁷³ These criteria define costs and gas prices that can be used in the evaluation as well as the discount interest rate (prime plus 3 percent).

⁷¹ *Management of Routine Solution Gas Flaring in Alberta: Report and Recommendations of the Flaring Report Team*, CASA, 1998, and *Gas Flaring, Incinerating and Venting in Alberta: Report and Recommendations for Upstream Petroleum Industry by the Flaring/Venting Project Team*, CASA, 2002.

⁷² Production, pipeline, and gas processing facilities must also comply with the flaring management framework.

⁷³ Refer to section 2.7, Economic Evaluation of Gas Conservation.

If a licensee determines that gas conservation is uneconomic, the complete decision-tree analysis and economic evaluation must be available for audit by the EUB. In addition, the EUB may request the following:

- Licensees to provide additional information to demonstrate that all practical options for gas conservation have been thoroughly evaluated
- Reevaluation if it appears that cost estimates are excessive or based on inappropriate technology

Audits of flare evaluations are in the form of random audits and targeted audits of sites flaring larger volumes, and there is no specific approval for each flare evaluation.

Figure A.2 Solution Gas Flaring/Venting Management Framework

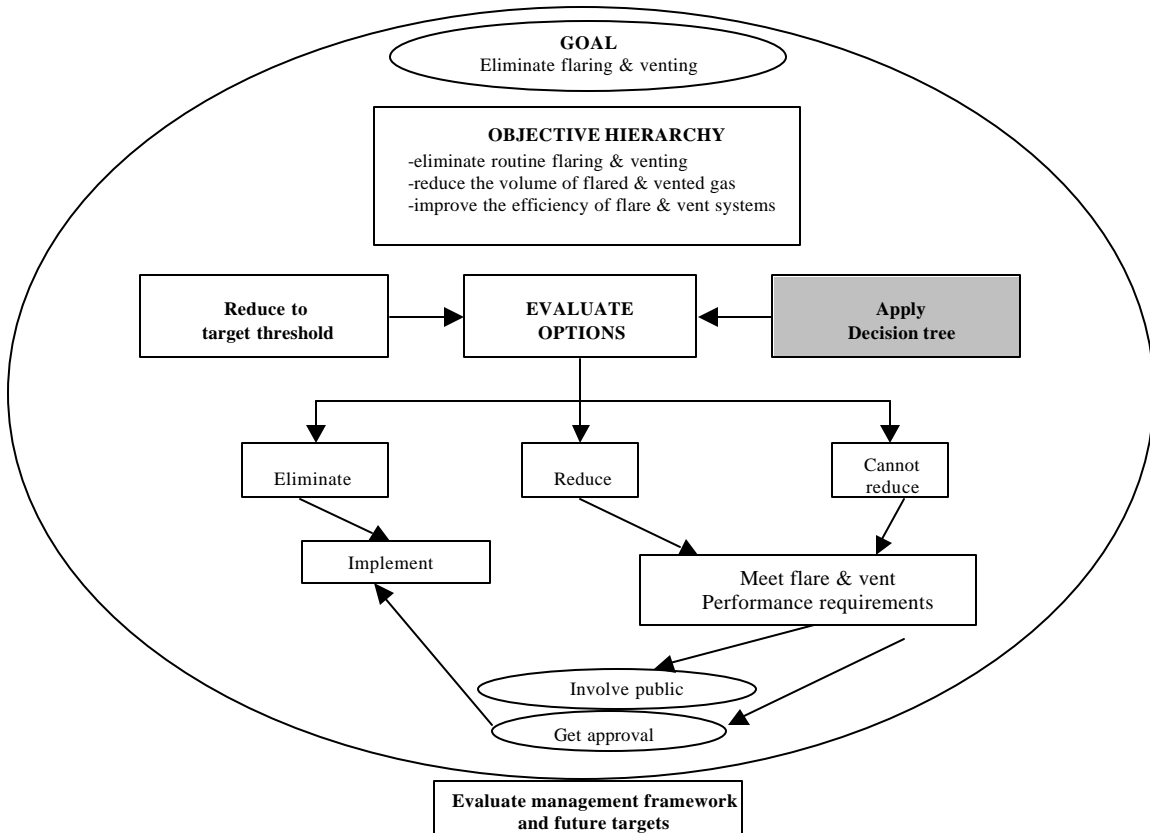
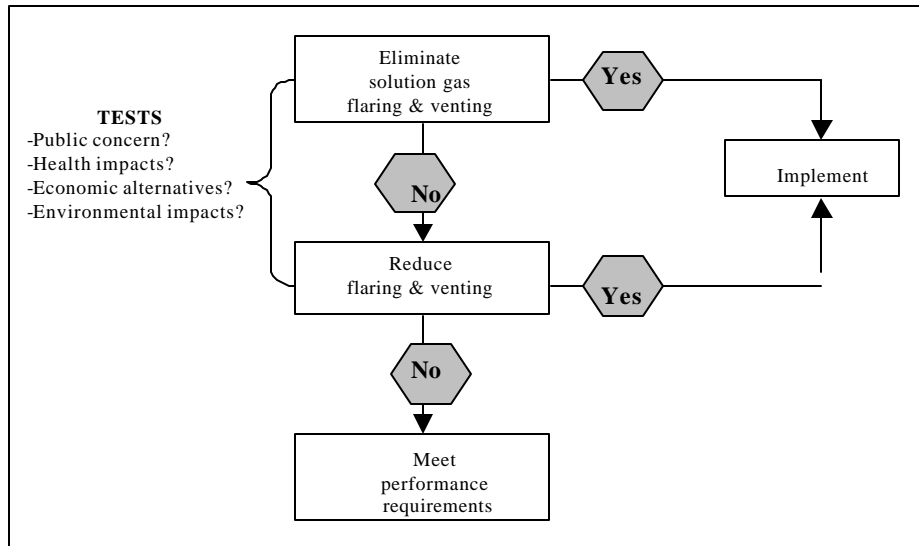


Figure A.3 Solution Gas Flaring and Venting Decision Tree



Performance Requirements

After a company has evaluated its gas flaring and venting options following the management framework and decision tree as described above, it may conclude that it is uneconomic to conserve gas. If that is the case, and if it has been approved by the EUB, the company will have to follow performance requirements for gas flaring and venting. *Guide 60* provides detailed regulatory requirements (including permit applications) for:

- Temporary and well-test flaring
- Gas battery flaring and venting
- Gas plant flaring and venting
- Pipeline flaring and venting
- Gas combustion requirements
- Venting and fugitive emissions management requirements.

These requirements include measures to ensure adequate flare ignition, liquid separation, and sour gas plume dispersion. The guide also describes limitations on venting unburned gas and includes strictly enforced requirements to prevent off lease odors.

Limited flaring of new gas wells for clean up and testing is permitted in Alberta. Regulatory permits (flare permits) are required in situations where temporary equipment is used (almost exclusively in testing of new wells), if the gas contains more than 5 percent hydrogen sulfide (H₂S), or if significant volumes are involved (that is, greater than 600 tcm for an exploration well). Flaring of sour gas is permitted only after operators can demonstrate that the flaring will comply with Alberta Ambient Air Quality Guidelines for H₂S and sulfur dioxide (SO₂). Operators are required to use the flaring management framework to assess opportunities to avoid or reduce well-test flaring (that is, prebuilt pipelines to connect new wells).

Design and operation of flares in permanent facilities such as gas processing plants are addressed as part of the application and approval processes for those facilities.

In addition, maximum annual flaring limits are imposed on gas plants, and there is a new pending requirement to limit the frequency of upset flaring events (that is, plant operators must improve facility reliability if more than six upset flaring events occur within a six-month period).

Measuring and Reporting

EUB measurement and accuracy requirements⁷⁴ for gas flaring and venting include:

- Reports of gas volumes greater than 0.1 tcm per month flared or vented by licensees of oil, bitumen, and natural gas production and processing facilities (including well tests). This includes reporting all emissions from routine operations; emergency conditions; and the depressurizing of pipeline, compression, and processing systems.
- Demonstrations by operators that gas volumes are accurately and consistently captured.
- Recommendations by the EUB that flared and vented gas be metered with equipment suited to source flow conditions.

Accurate engineering estimates may be accepted where meters are not practical and the measurement requirements can be met.

The EUB emphasizes the need to report flared and vented volumes accurately. All flared and vented gas must be reported to the EUB. This information is used to evaluate compliance with flaring reduction targets and to identify significant flaring sites for investigation. The information is also used in an annual public report published by the EUB. The EUB compiles these annual data from monthly production data operators are required to submit.

The annual report:

- Provides data and information of flared and vented gas and volumes for the various oil and gas industry sectors (well tests; gas plants; gas gathering systems; and oil, bitumen, and gas batteries)
- Reports in detail the volume of solution gas (gas from oil and bitumen batteries) conserved, flared, and vented on an annual basis
- Ranks operators according to the volume of solution gas flared, solution gas vented, total solution gas produced, and total oil from crude oil and bitumen batteries
- Reflects trends in conservation and initiatives being carried out
- Aims to increase awareness of flaring and venting volumes throughout Alberta and to encourage further gas conservation.

⁷⁴ EUB *Guide 60*, Section 10, summarizes measurement and reporting requirements for flared and vented gas. The EUB requires comprehensive reporting of oil and gas production and disposition (EUB *Guide 7: Production Accounting Handbook*).

Before the annual report is published, operators have the opportunity to verify the volumes of solution gas flared and vented submitted to the EUB.

Enforcement of Gas Flaring and Venting Regulations

Sound flaring management rules are not effective without adequate monitoring and enforcement. The EUB inspects and audits wells and production facilities that it licenses, as well as responds to public complaints related to petroleum industry operations.⁷⁵ The characteristics of oil production make it impossible to establish continuous surveillance of each field at the same time.

The EUB’s criteria for selecting sites to be inspected are based on:

- Operator performance and noncompliance history
- Sensitivity of the area (public proximity and environmental sensitivity)
- Inherent risk of the operation (potential impact level).

The monitoring process will ensure that operators with a noncompliant inspection history (for example, on gas flaring and venting) will be inspected more frequently than operators in good standing.

The EUB has established an “enforcement ladder system” to address noncompliance with regulatory requirements. The enforcement ladder is based on appropriate responses to the seriousness of the noncompliance and provides for escalating consequences if timely remedial actions are not taken or if repeat noncompliance occurs. The EUB’s generic enforcement ladder is summarized in Table A.4.

Table A.4 Enforcement Ladder

Enforcement Level	Nature of Noncompliance	Enforcement Action
Level 1	Minor noncompliance ⁷⁶ with reporting, measurement, or less significant facility requirements.	Written notification of noncompliance requesting that corrective action be taken within 30 days and that confirmation be provided to the EUB.

⁷⁵ The EUB is responsible for inspecting the over 110,000 operating wells, 15,911 oil batteries and associated satellites, 456 sweet gas plants, 247 sour gas plants, and over 300,000 km of pipelines that form the core of Alberta’s energy infrastructure.

⁷⁶ Minor noncompliance related to gas flaring and venting includes noncompliance with flare spacing requirements, gas usage not reported or reported inaccurately to the EUB, a flare stack height that does not conform to EUB requirements, and so forth.

Enforcement Level	Nature of Noncompliance	Enforcement Action
Level 2	<p>Major noncompliance⁷⁷ that has an immediate or potential threat to public safety, the environment, or resource conservation.</p> <p>Failure to respond to Level 1 enforcement.</p>	<p>Written notification to senior company management of noncompliance requesting:</p> <ul style="list-style-type: none"> • Noncompliance be corrected in 30 days • Written explanation of cause • Plan to ensure event does not recur • Confirmation that the noncompliance will not occur at other sites operated by the company. <p>Facility licenses may be suspended (that is, ordered to shut down) if necessary to protect public safety or the environment.</p>
Level 3	<p>Serious noncompliance⁷⁸ involving a “major” item and demonstrated disregard for regulations.</p> <p>Failure to respond to Level 2 enforcement.</p> <p>Repeat major noncompliance at any site operated by the company.</p>	<p>Suspension of the license until written approval is received from the EUB.</p> <p>Require that the suspension remain in effect until written approval is received from the EUB. This will not occur until a senior company representative provides, in writing, at a meeting, the following:</p> <ul style="list-style-type: none"> • Confirmation of compliance at this and all similar sites and operations • An explanation of why the company demonstrates disregard for EUB requirements • An action plan that could include third-party reviews at the company’s expense to ensure this disregard for requirements does not recur.
Level 4	<p>Failure to respond to Level 3 enforcement.</p> <p>Repeat serious noncompliance by the company within 12 months.</p>	<p>Per Level 2 and 3 (that is, potential license suspension), plus:</p> <ul style="list-style-type: none"> • Formal order to comply • Enact “refer” status. <p>“Refer” status results in greater scrutiny of the company and is considered by the EUB in determining whether pending and future applications for wells and facilities should be approved.</p>

⁷⁷ Major noncompliance includes failure to comply with any condition or permit or approval (well-test permits, volume exceeding approvals); exceeding the allowable annual flare volumes at a gas plant; and decision-tree process not completed for new, existing, and temporary flares and vents as required.

⁷⁸ Serious events include no attempt to comply with notifications, or consultations and flaring sour gas containing more than 50 mol/kmol H₂S, or flaring gas from a critical sour gas well without the required permit.

EUB reported⁷⁹ that 324 of 8,255 inspections in 2002 resulted in major or serious noncompliance assessments and that the noncompliance resulted in some 128 shutdowns of:

- Drilling rigs (14)
- Well-service rigs (1)
- Oil production batteries (45)
- Gas production facilities (16)
- Pipeline construction projects (11)
- Operating pipelines (41)

One of the most common reasons for the suspension of oil and gas production facilities is H₂S emissions (odors) associated with sour gas venting and equipment leaks. Typically, the shutdowns or suspensions remain in effect until the operator rectifies the noncompliance condition.

Other Measures That Affect Gas Flaring/Venting Volumes in Alberta

The characteristics of the upstream and downstream gas markets have significant impacts on the economics of gas flaring and venting. In principle, access to upstream and downstream gas transportation facilities, as well as direct access to customers, substantially decreases a producer's gas conservation costs.

Alberta's gas and electricity markets are fully liberalized and have the following characteristics:

- A competitive power generation market with approximately one-third of the total installed generation capacity sourced from natural gas
- Open access to upstream and downstream gas pipeline network
- Full wholesale and retail competition in the gas market that allows gas producers to either sell solution gas to gas purchasers or supply industrial and retail customers in their own right

As an additional incentive to conserve solution gas, in 1998 the minister of energy announced a program of royalty waivers on otherwise flared solution gas.⁸⁰ The program encourages reduction in the volume of solution gas being flared. The waiver is independent of end-use of solution gas and lasts for 10 years. Solution gas conserved before the beginning of December 1998 is not eligible for this royalty waiver program.

The program can be summarized as follows:

- Regulatory changes have been made to provide a royalty waiver on solution gas currently being flared because it is uneconomic to conserve the gas.
- The program covers all methods of conserving solution gas.

⁷⁹ EUB *Field Surveillance Provincial Summary* (report ST 57),

<http://www.eub.gov.ab.ca/bbs/products/STs/st57-2003.pdf>.

⁸⁰ Information Letter (IL) 99-19: Otherwise Flared Solution Gas Royalty Waiver Program, Department of Energy, June 11, 1999.